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Research Article

GJT 5 - Region specific high yielding sesame variety suitable for summer irrigated ecosystem

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Abstract
Sesame culture AT 231 was derived from hybridization between AT 90 and AT 104 followed by pedigree method of breeding. This culture was identified owing to its superior performance in the State trials conducted during summer irrigated conditions from 2010 to 2014 and released as Gujarat Junagadh Til 5(GJT 5) by 46th State Variety Release Committee (SVRC) during 2015. This culture recorded an average yield of 1241 kg/ha with the yield advantage of 22.39 per cent over the check G. Til 3 (1014 kg/ha). Besides its high yielding ability, Oil yield was 22.22 % higher than G. Til 3. It matured in 91 days and contains 46.98 per cent oil in its seeds, which are whitish in colour and bolder in size. This variety is best suited for summer irrigated conditions in Saurashtra region of Gujarat.

Key words
Sesamum indicum, Gujarat Junagadh Til 5, seed yield, medium duration

Introduction

Sesame (*Sesamum indicum* L.) is the first oil seed plant cultivated in the world and has a great importance in nutritional security, sustainable development and poverty alleviation of small and marginal farmers. Its importance in Indian culture is well known for wide range of usages as edible oil, food, biomedicine, health care (Shah, 2016). Sesame seed is also considered as rejuvenative and anti aging for human because good amount of quality proteins and essential amino acids especially methionine and remarkable antioxidant like lignans and tocopherol (Nupur *et al.,* 2010) are present in it.

Sesame is primarily a crop of developing countries growing by small farmers. India is the leading country worldwide, which covers sesame in about 2.18 million hectares and accounting the production of 0.73 million tonnes. Total world output of sesame seed is 4.8 million tons, out of which 51.3% is contributed by Asia with the major share of India (FAO, 2013). In India, Gujarat is the leading state and contributing approximately 30 % of country's total production. Sesame has a great potential of production for domestic and export markets. Seed with uniform size, lustrous, white, bold, sweet, free from flash, low free fatty acids (<2%), and free from pesticide residues is preferred in the global markets (Gopinath *et al.,* 2011). Comparatively low seed yield is one of the most important reasons that sesame needs breeding to produce more yields. The average productivity of sesame in India (342 kg/ ha) is far below than that of China (1487 kg/ha) and Egypt (1333 kg/ha). This may be due to low standards of husbandry, poor soils and low yielding varieties. Even though many high yielding varieties released in India, it has not contributed much to the oil scenario of the country. The progress in yield improvement is either stagnated or very slow during last 20 years. So, there is a great challenge for sesame breeder to step up yield.

Exploitation of sesame production potentiality is possible if the crop is grown in summer. Sesame is a short-day plant and generally requires fairly hot conditions (25-27^{o}C) for its optimum growth and yield. Temperatures below 15^{0}C and above 40^{0}C at flowering may lead to premature flower drop or production of sterile pollen (Ranganatha, 2010). Summer weather of Gujarat is suitable for sesame crop so that higher productivity can be realised in summer cultivation (Monpara and Vaghasia, 2016). Summer season provides favourable weather parameters such as photoperiod and temperature and unfavourable weather condition with respect to diseases and insect pests attack. Due to these reasons and assured moisture availability sesame crop gives higher production in summer than kharif season. Therefore, concerted efforts are needed to insist farmers for summer cultivation where irrigation facility is available. A gradual shift of sesame crop from kharif to summer is desirable. In Gujarat, summer sesame area is increasing now a day because of its low input cost with short life span in comparison to other crops. The earlier variety G.Til 3 was released during 2011 for summer cultivation in the region. However, due to continuous breeding effort, new culture have been developed with high yield potential which is suitable for summer irrigated condition. The white seeded sesame entry AT 231 has been identified and released as Gujarat Junagadh Til 5 (GJT 5) for summer irrigated conditions in Saurashtra region of Gujarat.

Materials and Methods

In order to improve sesame yield potential, hybridization programme was initiated involving elite parents in 2001 at the Agricultural Research Station, Junagadh Agricultural University, Amreli, a promising entry AT 231 was the derivative of the cross combination AT 90 x AT 104. Elite plants with desirable characters contributing towards higher yield were selected from F_2 generation onwards. Segregating material was handled through pedigree method of plant breeding. Preliminary field level screening of advanced generations showed encouraging yield performance and the culture AT 231 was identified as the best. This culture was evaluated in summer 2010 to 2014 along with several other entries and the checks, *viz.*, G.Til 2 and G.Til 3 at two locations of the Saurashtra region in a randomised block design with four replications in different categories of State trials, i.e. PET (Preliminary Evaluation Trial), SSVT (Small Scale Varietal Trial) and LSVT (Large Scale Varietal Trial). All these trials consisted of plots with variable rows (5 for PET, 6 for SSVT and 10 for LSVT) of 6.0 m length. Seeds were hand drilled in rows spaced 30 cm apart and the crop was thinned at 15-20 days after germination keeping plant to plant distance of 10 cm. All agronomic practices were followed for raising a good crop. Net plot of 5.4 m length with variable rows (3 for PET, 4 for SSVT and 8 for LSVT) was harvested to collect data on seed yield. Five randomly selected plants from net plot were used to collect data on yield attributing traits. This culture was also nominated for inclusion in AICRP trials and it was evaluated in Initial varietal trial (IVT) and Advanced varietal trial (AVT) during Rabi/summer-2012 to 2014 comprising three zones across India. Field screening was also carried out for its reaction to pests and diseases.

Results and Discussion

The yield potential of AT 231 was tested with two predominant varieties over years and manifested yield superiority against the checks G.Til 2 and G.Til 3 in different yield trials. The seed yield data recorded for this newly developed variety along with checks during summer 2010 -2014 at two locations of Saurashtra region are presented in Table 1. The AT 231 recorded the mean seed yield of 1241 kg/ha as compared to that of 999 kg/ha of G.Til 2 and 1014 kg/ha of G.Til 3 with an yield improvement of 24.22% and 22.39% over check variety G.Til 2 and G.Til 3, respectively. This proposed entry found significantly superior to better check G. Til 3 in four out of seven trials with the frequency of ranking all time in first non significant group. Similarly, oil production (kg/ha) of this culture was higher to the tune of 24.57% and 22.22% over G.Til 2 and G.Til 3, respectively (Table 2). The per day oil production was 6.41 kg/ha with an increment of 22% over the checks.

The culture AT 231 was also tested under All India Coordinated Research Project (AICRP) trials during Rabi/summer season in Initial Varietal Trial (IVT) and Advanced Varietal Trial (AVT) over locations in all the zones across the country from 2012 to 2014. It performed well in all the zones over local checks, but not over the national checks (Table 3). The overall yield performance of AT 231 (531kg/ha) revealed a yield increase of 5.4 per cent over local checks (504 kg/ha).

The entry AT 231 was screened for reaction to major pests and diseases under field conditions at Amreli and various AICRP centres during Rabi/summer seasons. On an overall, incidence of diseases and pests was low at Amreli (Table 4) than that of at AICRP centres (Table 5). Average data of AICRP centres (Table 5) reveals that AT 231 was more or less similar to national and local checks for reaction to diseases and pests, however, incidence of powdery mildew and leaf webber was less compared to check varieties.

The morphological features of AT 231 and two check varieties (Table 6) indicates that AT 231 has distinct morphological characters for easy identification. AT 231 have narrow oblong capsules which arises more than one per leaf axil, while G.Til 3 possessed broad oblong capsules singly raised per leaf axil. Capsules are glabrous in AT 231, while hairy in G. Til 2. The AT 231 has relatively tall plant stature with higher number of productive capsules per plant compared to both the checks. It has mean maturity duration of 91days, oil content in seed of 46.98% and 1000 seed weight of 3.63g with whitish and bolder seed so that suitable for export purpose.

On the grounds of its above special features and superior yield performance, AT 231 has been accepted by 46th State Variety Release Committee during 2015 to release as a Gujarat Junagadh Til 5 (GJT 5) for commercial cultivation to the farmers during summer season in Saurashtra region of Gujarat. Large quantities of basic seed have been produced for popularising this variety. The GJT 5 has been registered (IC 611688) and conserved under long term storage at NBPGR, New Delhi.

References

FAO, 2013. Food and Agricultural Organization of the United Nations, Statistical Database. http://faostat.fao.org/

Gopinath, K. A., Venkateswarlu, B., Venkateswarlu, S., Yadav, S. K.,Balloli, S. S., Srinivasa Rao, Ch., Prasad, Y. G. and Maheswari, M. 2011.

Organic sesame production, Technical Bulletin, Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India. pp 34.

Nupur, M., Bhat, K.V. and Srivastava, P.S. 2010. Variation in fatty acid composition in Indian germplasm of sesame. J. Am. Oil Chem. Soc., 87(11):1263-1269. http://dx.doi.org/10.1007/s11746-010-1615-9

Monpara, B. A. and Vaghasia, D. R. 2016. Optimizing sowing time and row spacing for summer sesame growing in semi-arid environments of India. Int. J. Curr. Res. Acad. Rev., 4 (1): 122-131.

Ranganatha, A.R.G., 2010. Improved Technology for Maximizing Production of Sesame. (Revised Ed) Project Coordinator, AICRP on Sesame & Niger, ICAR, JNKVV Campus, Jabalpur, pp.1-17.

Shah, N. C. 2016. *Sesamum indicam* (Sesame or *Til*): Seed and oil- A historical and scientific evaluation from Indian perspective. Asian Agri-History, 20(1):3-19.

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Table 1. Performance of sesame culture AT 231 in various trials for seed yield (kg/ha) under summer irrigated condition of Saurashtra region

Trial	Location	AT-231	G.TIL 2 (C)	G.TIL 3 (C)	S.Em.±	C.D. at 5 %	C.V. %
PET (Summer 2010)	Amreli	797	607	642	83.44	243	19.58
SSVT (Summer 2011)	Amreli	1307*	977	1093	63.61	184	11.06
LSVT (Summer 2012)	Amreli	691	538	611	48.09	138	18.84
	Junagadh	2344*	1875	1904	116.66	291	11.1
LSVT (Summer 2013)	Amreli	Trial failed due to shortage of water after germination					
	Junagadh	849*	-	633	55.68	163	15.03
LSVT (Summer 2014)	Amreli	1074*	-	806	80.82	236	18.11
	Junagadh	1626	-	1410	121.00	352	16.67
	Weighted mean	**1241**	**999**	**1014**			
	% Increase over		**24.22**	**22.39**			
Frequency in first non significant group		7/7	1/4	3/7			

* significant at 5 % level

Table 2. Calculated oil production of AT 231 and checks

Character	AT 231	G.TIL 2 (C)	G.TIL 3 (C)
Seed yield (kg/ha)	1241	999	1014
Oil content (%)	46.98	46.88	47.06
Oil yield (kg/ha)	583	468	477
% increase over	**-**	**24.57**	**22.22**
Per day oil production (kg/ha)	6.41	5.26	5.24
% increase over	**-**	**21.86**	**22.33**

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Table 3. Performance (seed yield, Kg/ha) of AT 231 under AICRP trials during Rabi/summer-2012 to 2014

Trial	AT 231	RT 54 (NC)	TKG 22 (NC)	Zonal check[#]
Zone-I				
IVTS 2012 (3)	671	609	559	417
AVTS 2013 (6)	584	563	537	532
AVTS 2014(3)	362	-	364	515
Weighted mean	**550**	**579**	**494**	**528**
Zone-II				
IVTS 2012 (1)	622	500	622	239
AVTS 2013 (1)	403	410	417	545
Weighted mean	**513**	**455**	**520**	**392**
Zone-III				
IVTS 2012 (3)	516	593	720	564
AVTS 2013 (2)	514	654	593	552
AVTS 2014 (2)	424	-	1322	377
Weighted mean	**500**	**618**	**855**	**494**
Overall weighted mean	**531**	**575**	**623**	**504**

Source: AICRP(S&N) report (2012 to 2014); [#] Zonal check varies from zone to zone
Figure in parenthesis is number of locations

Table 4. [#]Reaction of sesame culture AT 231 for diseases and pests under state trials at Amreli (Summer-2011 to 2014)

	AT 231	G.Til 2 (C)	G.Til 3 (C)
Disease			
Macrophomina(mean % plant damage)	0.58	0.91	0.18
Phyllody (mean % plant damage)	0.00	0.00	0.13
Pests			
White fly (mean no. per 3 leaves)	2.35	1.79	1.84

[#]Alternaria & Cercospora leaf spots, Phytopthora and powdery mildew diseases and pests like leaf webber, gallfly, mites and jassids were not observed during testing period.

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Table 5. Overall reaction of sesame culture AT 231 to disease and pest under hot spot locations of AICRP (Vridhachalam, Jagatial and Berhampore) during Rabi/summer-2012 to 2014

	AT 231	TKG 22 (NC)	RT 54 (NC)	Zonal check[#]
Disease				
Macrophomina(mean % plant damage)	18.84	18.35	33.30	18.51
Phyllody (mean % plant damage)	1.70	1.95	0.70	1.95
Altrneria (0-9 scale)	2.38	2.25	3.00	2.00
Powdery Mildew (0-9 scale)	2.75	3.50	3.00	3.50
Pest				
leaf webber/*Antigastra* (% infestation/grade)	9.30 (R)	10.21 (MR)	11.17 (MR)	9.95 (R)

NC= National check, R= Resistant, MR= Moderately resistant; # Zonal check varies from zone to zone
Source: AICRP(S&N) report (2012 to 2014).

Table 6. Morphological features of AT 231 and checks

Sr.	Characteristics	AT 231	G.Til 2 (C)	G.Til 3 (C)
1.	Flower petal colour	Light purple	Light purple	Light purple
2.	Flower petal hairiness	Sparse	Sparse	Sparse
3.	Branching habit	Medium	Few	Medium
4.	Stem hairiness	Absent	Sparse	Absent
5.	Leaf arrangement	Opposite	Opposite	Opposite
6.	Leaf lobes	Slightly lobed	Slightly lobed	Slightly lobed
7.	Leaf size	Medium	Medium	Medium
8.	Capsule hairiness	Absent	Dense	Absent
9.	Locules/capsule	Four	Four	Four
10.	Capsule shape	Narrow oblong	Narrow oblong	Broad oblong
11.	Capsules/leaf axil	More than one	More than one	One
12.	Seed coat colour	White	White	White
13.	Days to 50% flowering	39	37	39
14.	Days to maturity	91	89	91
15.	Primary branches/plant	2.98	1.80	2.38
16.	Plant height (cm)	70	53	61
17.	Capsules/plant	58	41	52
18.	Capsule length	2.96	2.36	3.35
19.	Seeds/capsule	77	62	80
20.	1000 seed wt (g)	3.63	3.30	3.70
21.	Oil content (%)	46.98	46.88	47.06